

WHAT IS CLAIMED IS:

1. An electronic gas flow measurement device for use with an orifice meter mounted in a gas pipeline, said device comprising:

- 5 (a) a housing;
- (b) a computer enclosed with the housing, and having a microprocessor and a read-only memory (ROM);
- (c) data input means, for entering data in the ROM;
- (d) data output means, for retrieving data stored in the ROM;
- 10 (e) means for receiving gas temperature inputs; and
- (f) means for receiving gas pressure inputs from upstream and downstream of the orifice plate of the orifice meter;

wherein:

- 15 (g) the ROM may store look-up tables of intermediate values for selected gas flow calculation parameters determined in accordance with one or more selected calculation method for selected ranges of gas temperature, density, and pressure differentials; and
- (h) the device is programmed with software for:
 - h.1 selecting intermediate values from the look-up tables corresponding to gas
20 temperature and temperature inputs; and
 - h.2 processing the selected intermediate values to calculate gas flow rates adjusted for temperature, pressure, and density, in accordance with one or more selected gas flow rate calculation methods.

2. The device of Claim 1, wherein the housing is an explosion-proof housing.

3. The device of Claim 1, wherein the data input means comprises a keypad interface.

5 4. The device of Claim 1, wherein the data input means comprises a portable data storage medium.

5. The device of Claim 4, further comprising an MMC card reader, and wherein the portable data storage medium is an MMC card.

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6. The device of Claim 1, wherein the data output means comprises a digital read-out.

7. The device of Claim 1, wherein the data output means comprises an MMC card.

15 8. The device of Claim 1, wherein the data output means comprises a graphical user interface.

9. The device of Claim 1, wherein the data output means comprises a hard-wired data communication link.

10. The device of Claim 1, wherein the data output means comprises a wireless data communication link.

5 11. The device of Claim 1, wherein the means for receiving gas temperature inputs comprises a resistive temperature device.

12. The device of Claim 1, further comprising one or more batteries for supplying electrical power to the computer.

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13. The device of Claim 1, wherein the software is adapted to perform calculations using methods conforming with AGA-3 and AGA-8.

14. The device of Claim 1, wherein the software is adapted to perform calculations using
15 methods conforming with AGA-3 and NX-19.

15. An electronic gas flow measurement device for use with a turbine meter mounted in a gas pipeline, said device comprising:

- (a) a housing;
- (b) a computer having a microprocessor and a read-only memory (ROM);
- 5 (c) data input means, for entering data in the ROM;
- (d) data output means, for retrieving data stored in the ROM;
- (e) turbine pulse counting means, for counting pulses of the turbine in the turbine meter;
- (f) means for receiving gas temperature inputs; and
- 10 (g) means for receiving gas pressure inputs from upstream of the turbine meter;

wherein:

- (h) the data input means may be used to store, in the ROM:
 - h.1 look-up tables of intermediate values for selected gas flow calculation parameters determined in accordance with one or more selected calculation methods for selected ranges of gas temperature, density, and pressure; and
 - h.2 look-up tables of "K" values for the turbine, corresponding to a selected range of gas flow rates; and
- (i) the device is programmed with software for:
 - 20 i.1 selecting intermediate values from the look-up tables corresponding to gas temperature and pressure inputs;
 - i.2 selecting turbine "K" factors from the look-up tables corresponding to turbine pulse count inputs; and

- i.3 processing the selected intermediate values and "K" factors to calculate gas flow rates adjusted for temperature, pressure, and density, in accordance with one or more selected gas flow rate calculation methods.

5 16. The device of Claim 15, wherein the housing is an explosion-proof housing.

17. The device of Claim 15, wherein the data input means comprises a keypad interface.

18. The device of Claim 15, wherein the data input means comprises a portable data storage
10 medium.

19. The device of Claim 18, further comprising an MMC card reader, and wherein the portable data storage medium is an MMC card.

15 20. The device of Claim 15, wherein the data output means comprises a digital read-out.

21. The device of Claim 15, wherein the data output means comprises an MMC card.

22. The device of Claim 15, wherein the data output means comprises a graphical user
20 interface.

23. The device of Claim 15, wherein the data output means comprises a hard-wired data communication link.

24. The device of Claim 15, wherein the data output means comprises a wireless data communication link.

25. The device of Claim 15, wherein the means for counting turbine pulses comprises a magnetic sensor.

26. The device of Claim 15, wherein the means for counting turbine pulses comprises an optical sensor.

27. The device of Claim 15, wherein the means for receiving gas temperature inputs comprises a resistive temperature device.

28. The device of Claim 15, wherein the power source is a battery.

29. The device of Claim 15, wherein the software is adapted to perform calculations using methods conforming with AGA-7 and AGA-8.

30. The device of Claim 15, wherein the software is adapted to perform calculations using methods conforming with AGA-7 and NX-19.

31. A method of calculating gas flow rates in conjunction with an orifice meter mounted in a gas pipeline, said method comprising the steps of:

- (a) calculating look-up tables comprising intermediate values for selected gas flow calculation parameters, in accordance with one or more selected calculation methods, for selected ranges of one or more selected input variables;
- (b) collecting data readings for the selected input variables for a gas flowing in the pipeline;
- (c) using the appropriate look-up tables, determining a set of intermediate values for the selected gas flow calculation parameters, corresponding to the collected data readings; and
- (d) using the intermediate values determined from the look-up tables as input variables, calculating a gas flow rate using one or more selected calculation methods.

32. The method of Claim 31, wherein the one or more selected input variables include one or more variables selected from the group consisting of differential gas pressures, gas temperature, and gas density.

33. The method of Claim 31, wherein the calculation methods used in the step of calculating a gas flow rate include methods conforming with AGA-3 and AGA-8.

34. The method of Claim 31, wherein the calculation methods used in the step of calculating a gas flow rate include methods conforming with AGA-3 and NX-19.

35. The method of Claim 31, wherein:

- (a) the look-up tables and the collected data readings for the selected input variables are stored in a read-only memory; and
- (b) the steps of determining a set of intermediate values and calculating a gas flow rate are performed using a programmed computer.

36. The method of Claim 31, further comprising the step of storing the calculated gas flow rate in a read-only memory in a computer.

37. A method of calculating gas flow rates in conjunction with a turbine meter mounted in a gas pipeline, said method including the steps of:

- (a) calculating look-up tables comprising intermediate values for selected gas flow calculation parameters, in accordance with one or more selected calculation methods, for selected ranges of selected input variables;
- (b) collecting data readings for the selected input variables for a gas flowing in the pipeline;
- (c) using the appropriate look-up tables, determining a set of intermediate values for the selected gas flow calculation parameters, corresponding to the collected data readings;
- (d) determining the "K" factor for the turbine over a selected range of turbine pulse frequencies, and preparing a corresponding look-up table;
- (e) collecting a turbine pulse frequency reading, and determining a corresponding "K" factor from the corresponding look-up table; and

- (f) using the set of intermediate values and "K" factor determined from the look-up tables as input variables, calculating a gas flow rate using one or more selected calculation methods.

5 38. The method of Claim 37, wherein the one or more selected input variables include one or more variables selected from the group consisting of differential gas pressures, gas temperature, and gas density.

10 39. The method of Claim 37, wherein the calculation methods used in the step of calculating a gas flow rate include methods conforming with AGA-7 and AGA-8.

40. The method of Claim 37, wherein the calculation methods used in the step of calculating a gas flow rate include methods conforming with AGA-7 and NX-19.

15 41. The method of Claim 37, wherein:

- (a) the look-up tables and the collected data readings for the selected input variables are stored in a read-only memory; and
- (b) the steps of determining a set of intermediate values, determining a "K" factor corresponding to the collected turbine pulse frequency reading, and calculating a gas flow rate, are performed using a programmed computer.

20 42. The method of Claim 37, further comprising the step of storing the calculated gas flow rate in a read-only memory in a computer.